Vancouver Island Generating Project

Reliability of Vancouver Island Supply and Condition of HVDC System

by

System Planning, Transmission

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System Planning Panel

105-03688/

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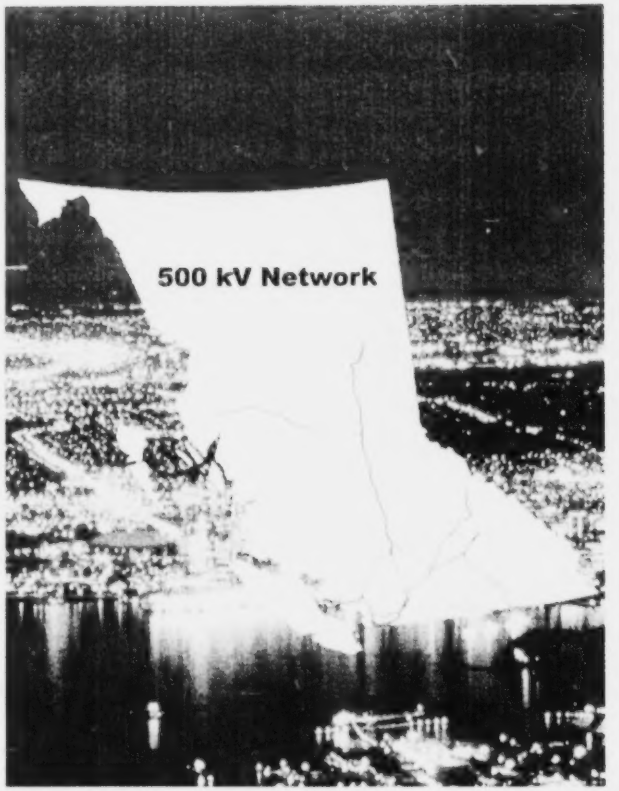
Presentation Outline

- System Planning Objectives
- Single Contingency Planning
- End of Life Strategies
- HVDC Transmission Supply Resource
- Condition of HVDC System
- Conclusions

System Planning Objectives

"Our Mission is to shape tomorrow's electric system to assure customers of a reliable and efficient transport of electricity"



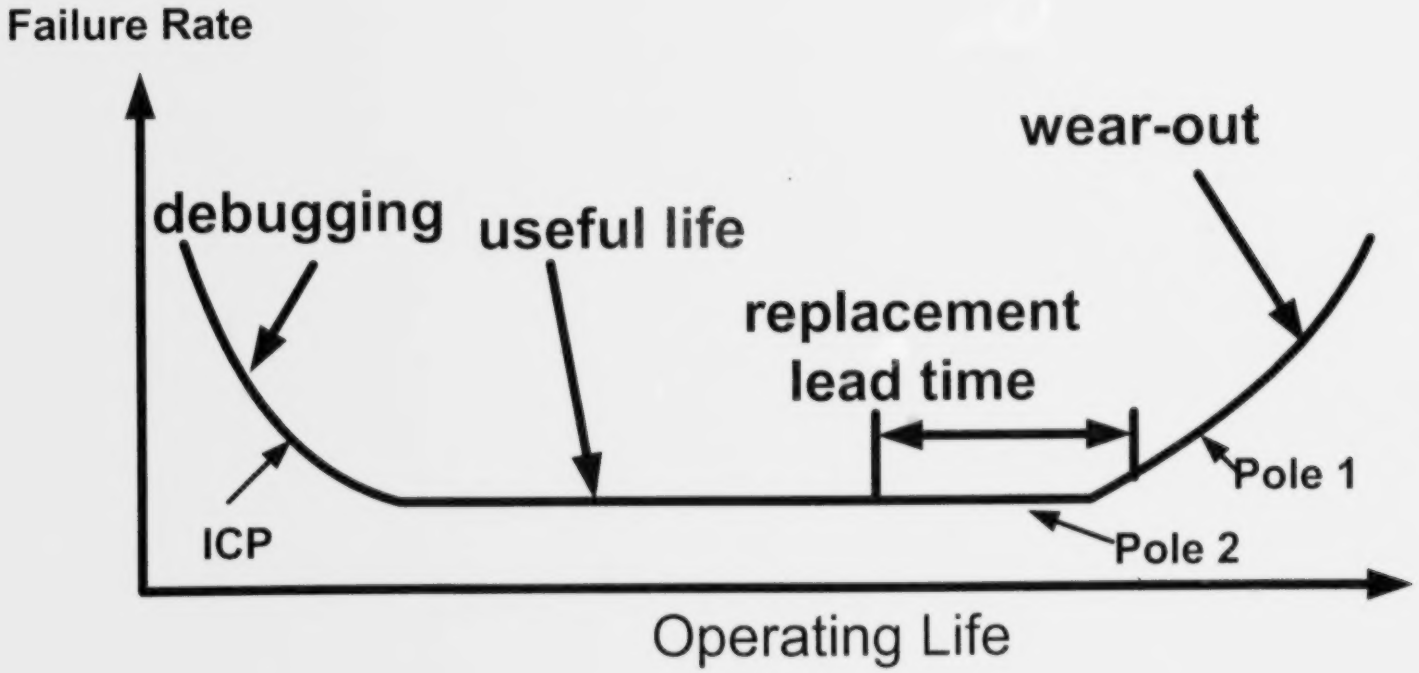
Vancouver Island System Map

Unreliability Consequences

- Resource shortages in a power system impacts all customers.
- Unreliability in a power system is expensive to our customers.

Life-Time Component Reliability

What does the failure rate of components look like over their lifetime?



Single Contingency Criteria Results in Reliable System Performance if the "Plan for End of Life Strategy" is Applied

- What is Single Contingency Planning?
- What is the required performance?
- What are the implied conditions?
- What planning assumptions must be made to meet these conditions?

Strategy #1 Plan For End of Life (Preferred Strategy)

- What is this Strategy?
- What is the risk of this strategy?
- What is the outcome of this strategy?

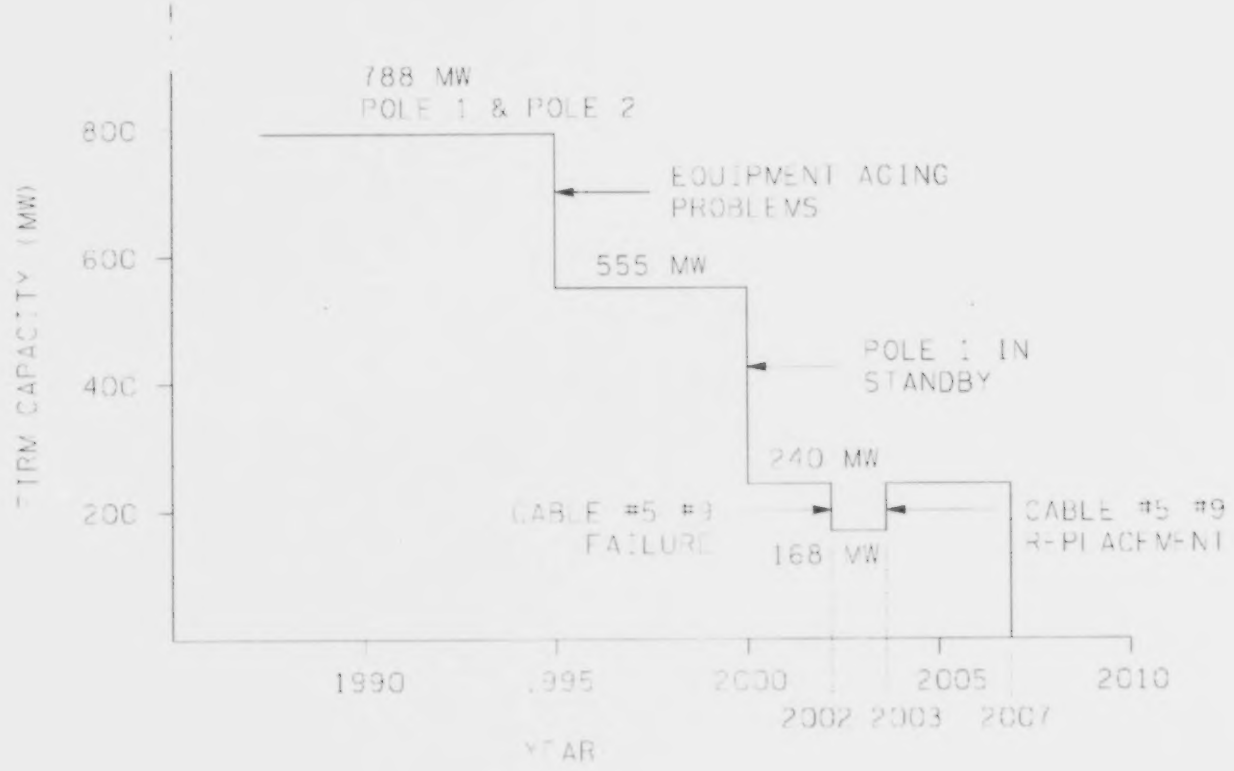
Strategy #2 Run to Failure

- What is this Strategy?
- What is the risk of this strategy?
- What is the outcome of this strategy?

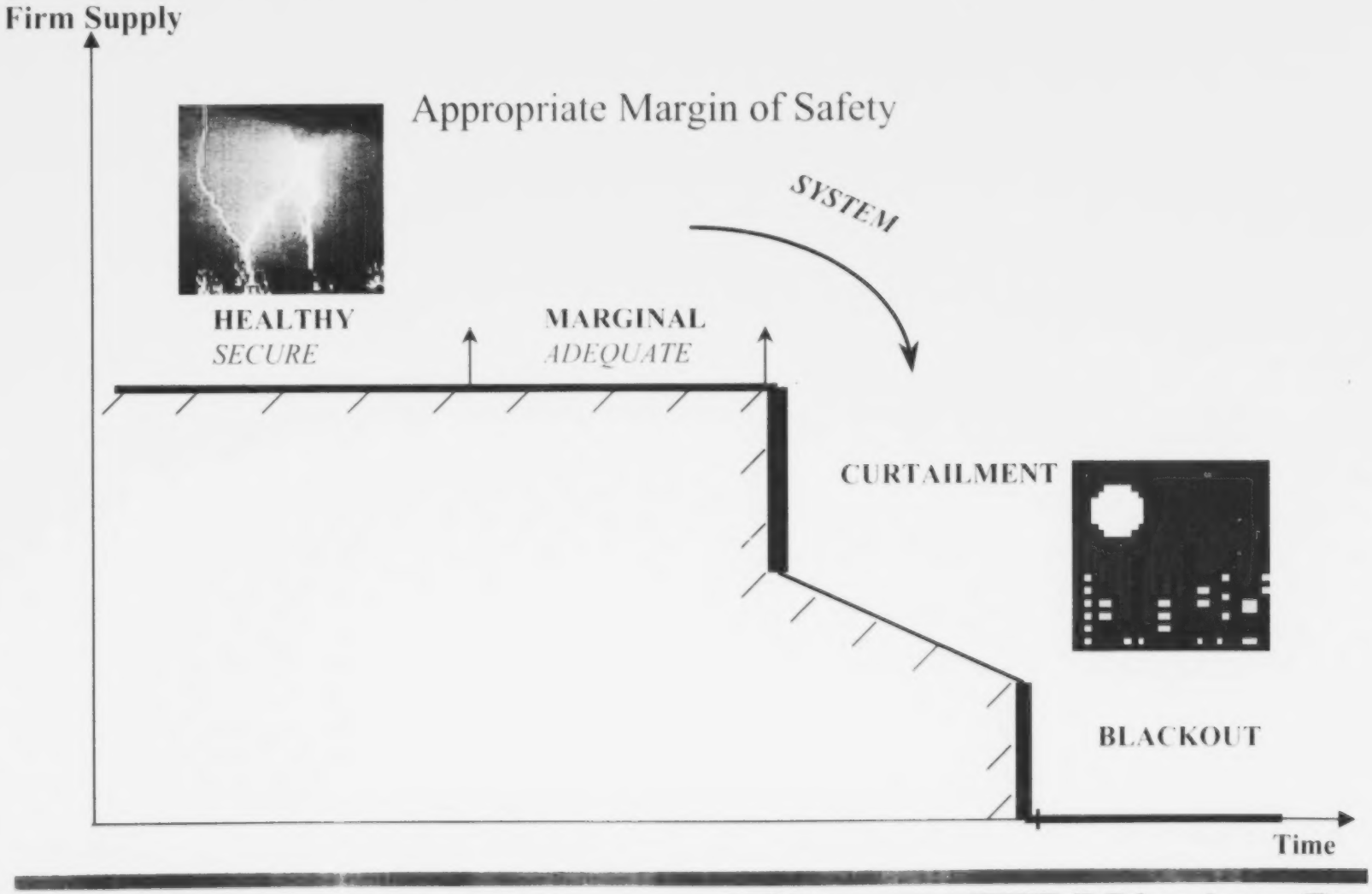
Planning Assumptions for the HVDC

- We are implementing the "Plan for End of Life Strategy" for the HVDC system.
- HVDC investments will continue until a replacement is built.
- How is this strategy implemented?

Firm Capacity of HVDC



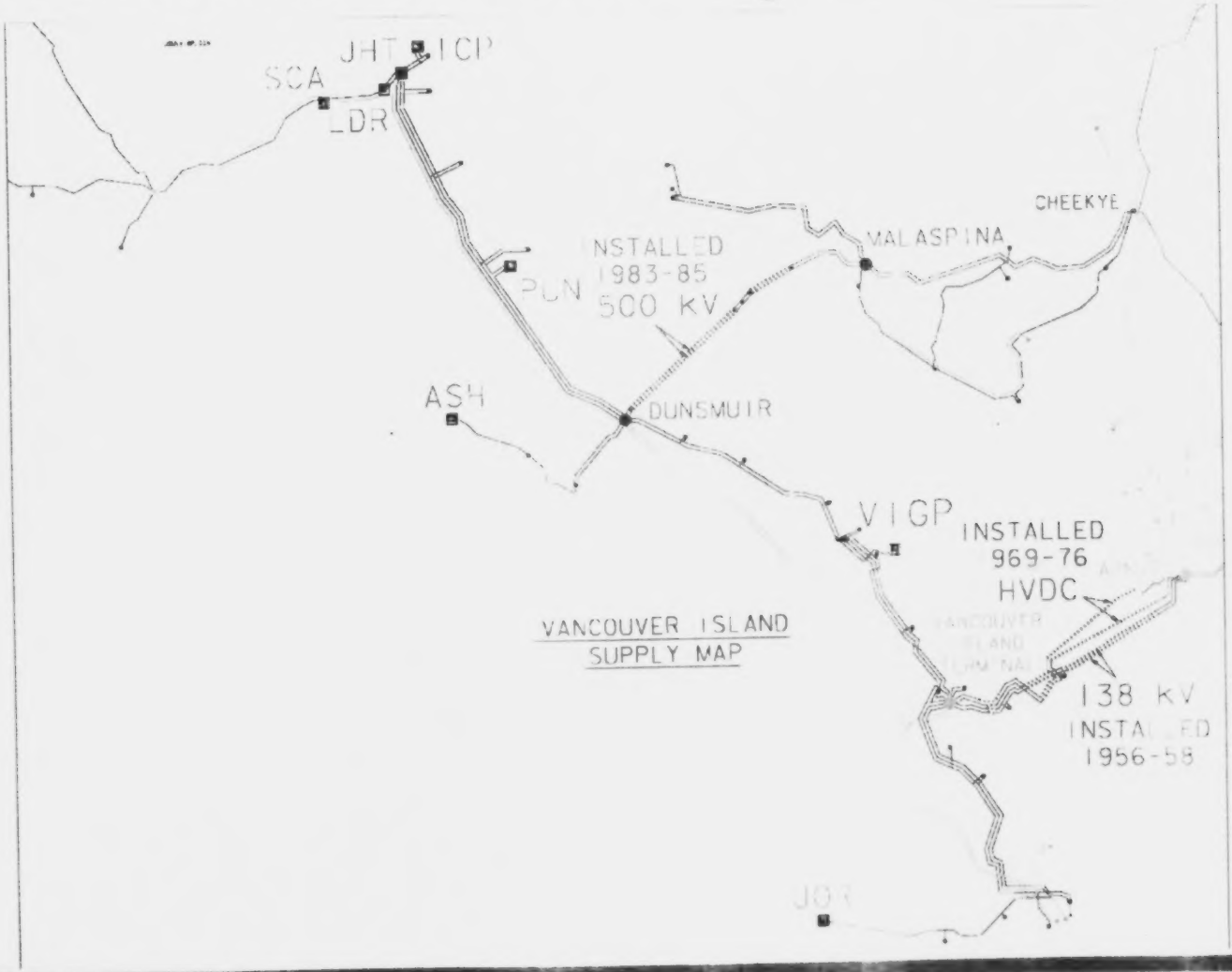
How Reliable should the System be ?



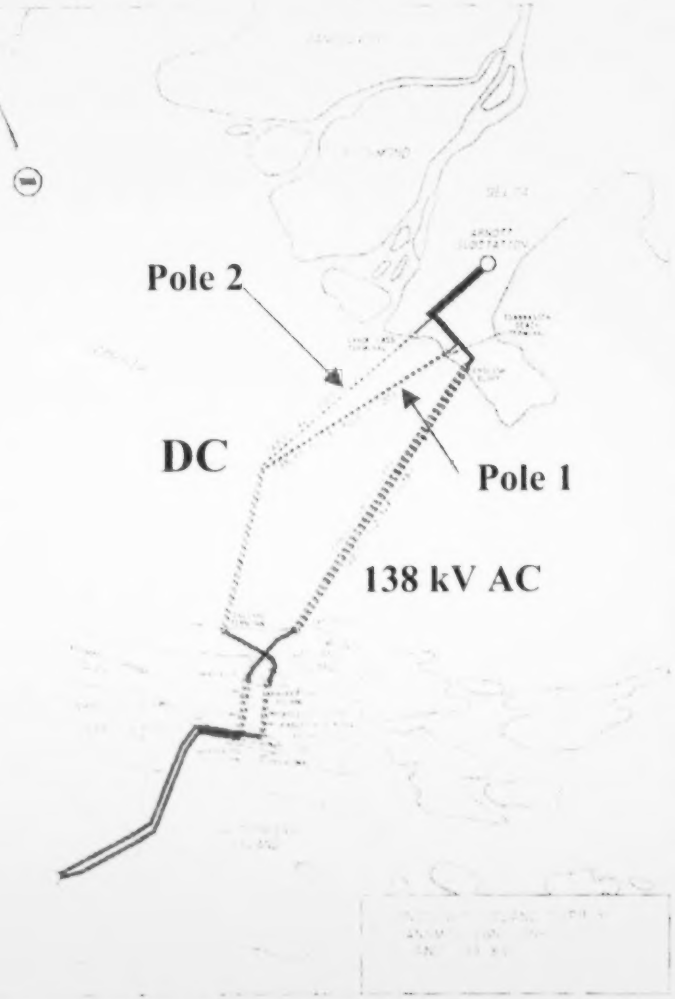
Presentation Outline

- ✓System Planning Objectives
- ✓Single Contingency Planning
- ✓End of Life Strategies
- ✦HVDC Transmission Supply Resource
- ✦Condition of HVDC System
- ✦Conclusions

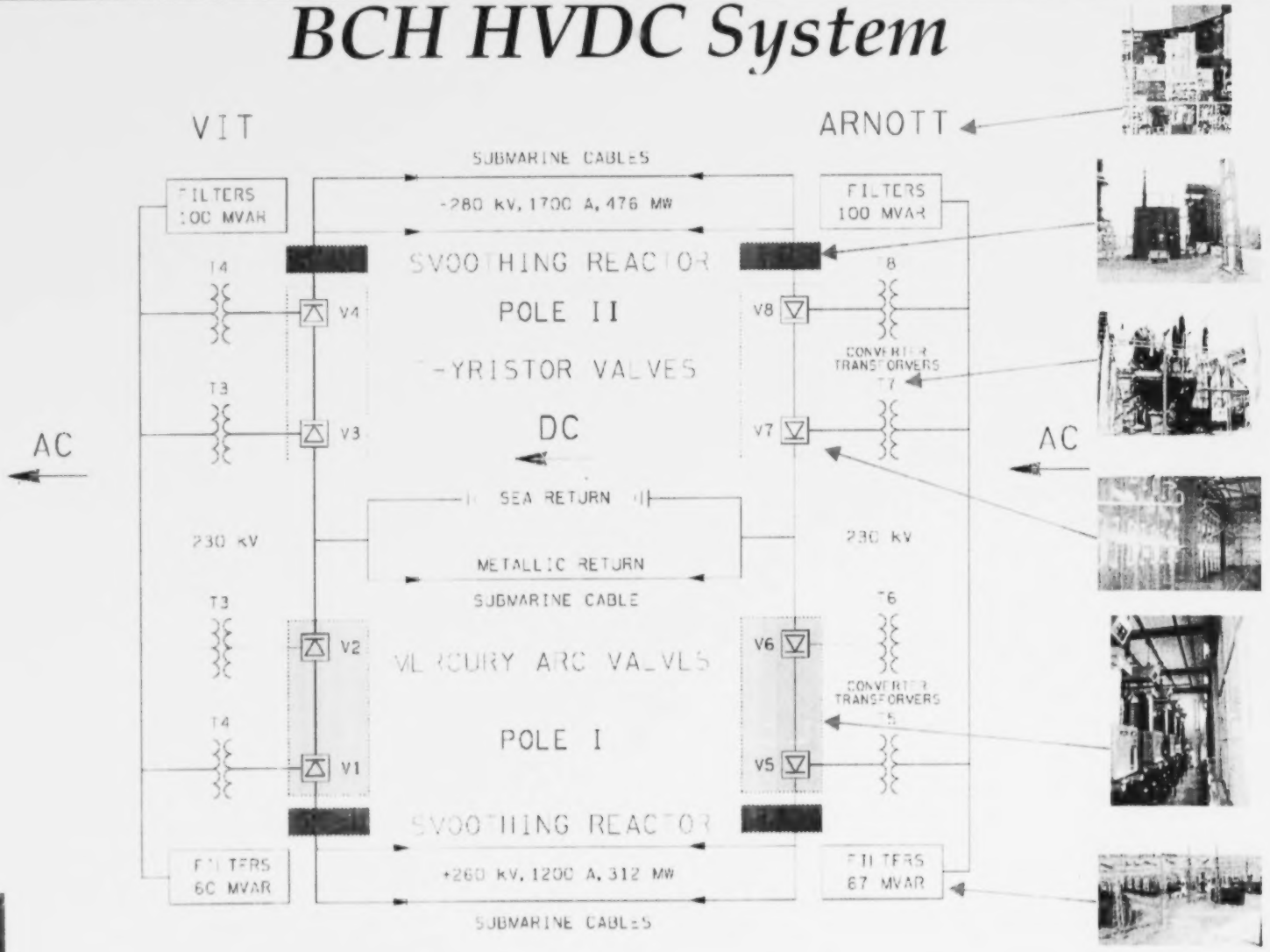
Vancouver Island System Map



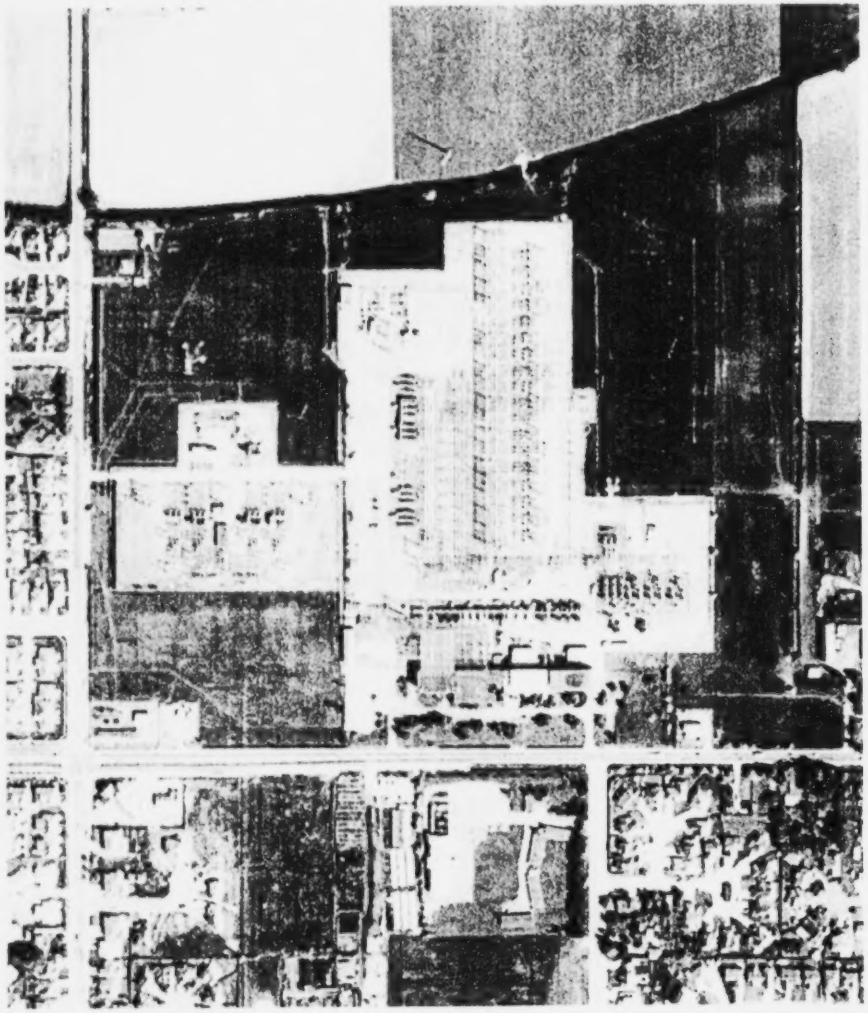
HVDC Single Line



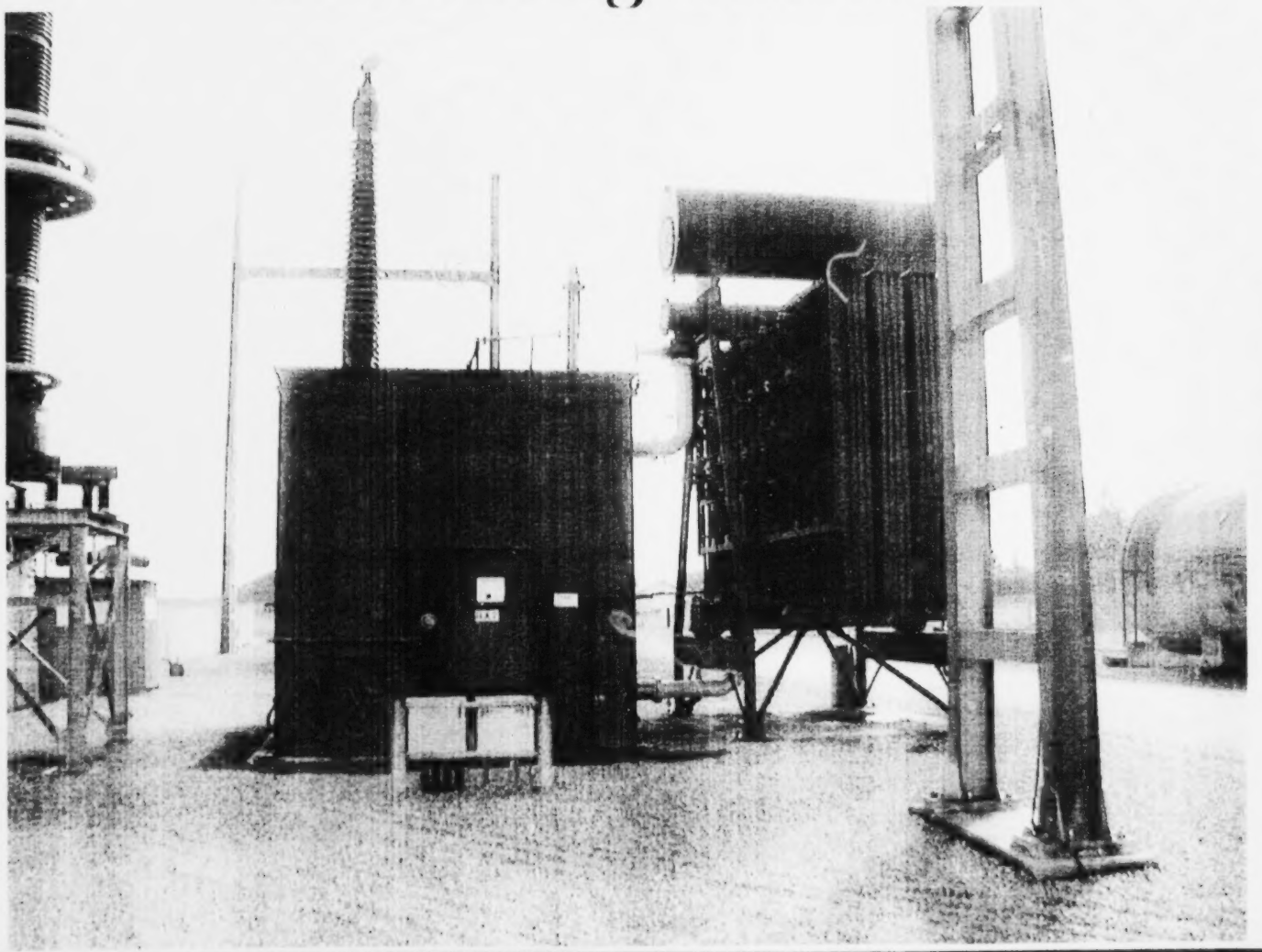
BCH HVDC System



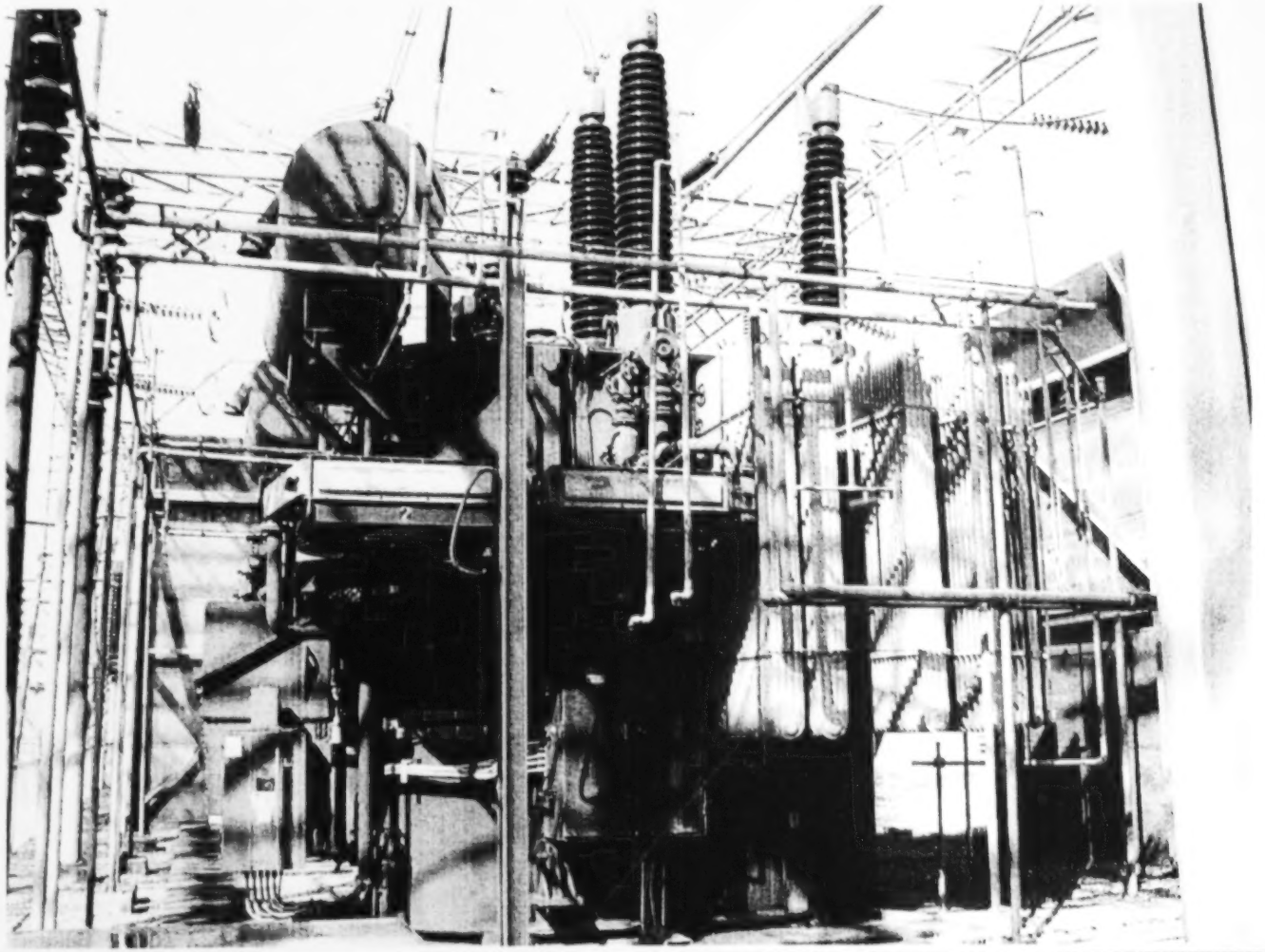
Arnott Terminal



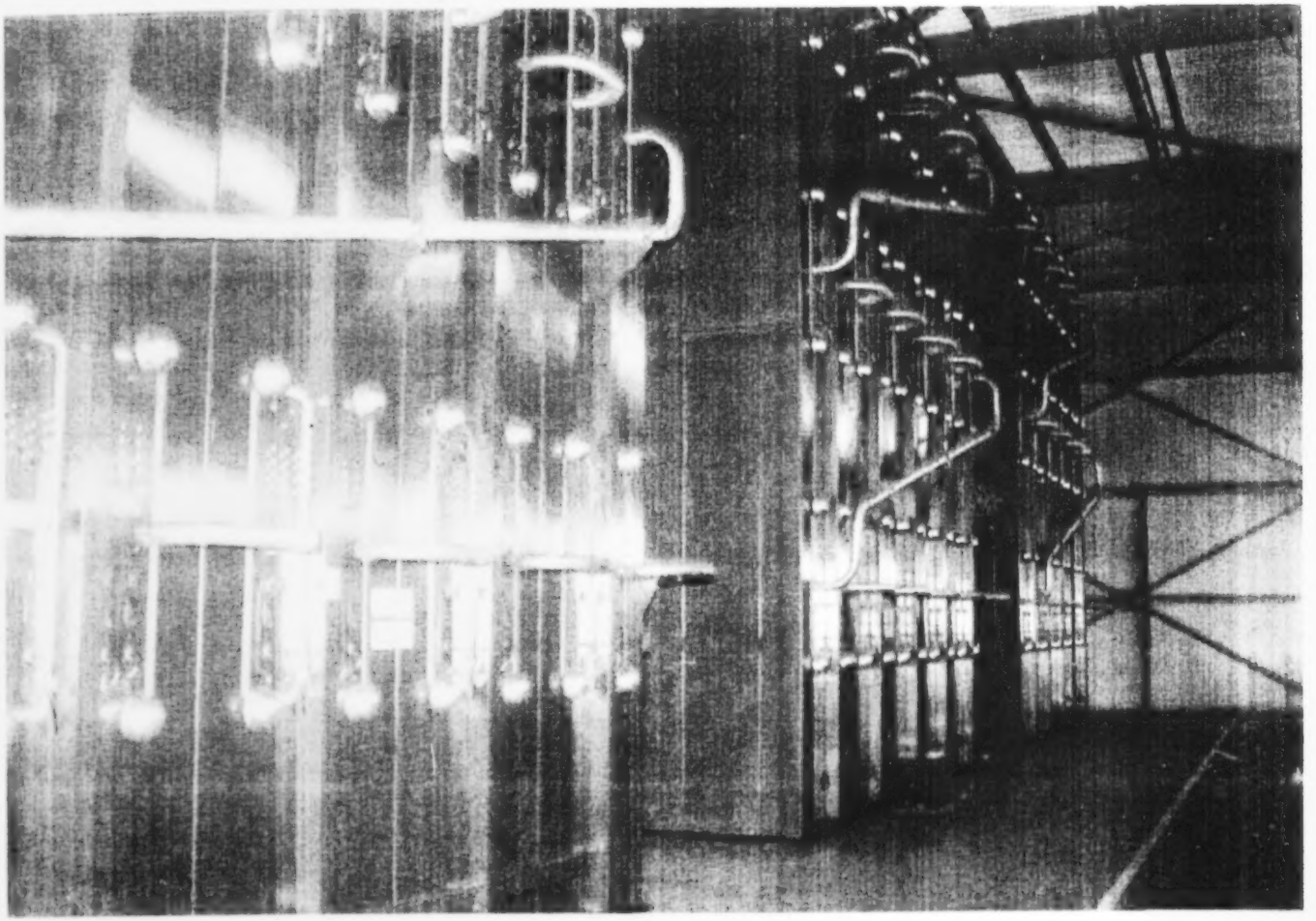
Smoothing Reactors



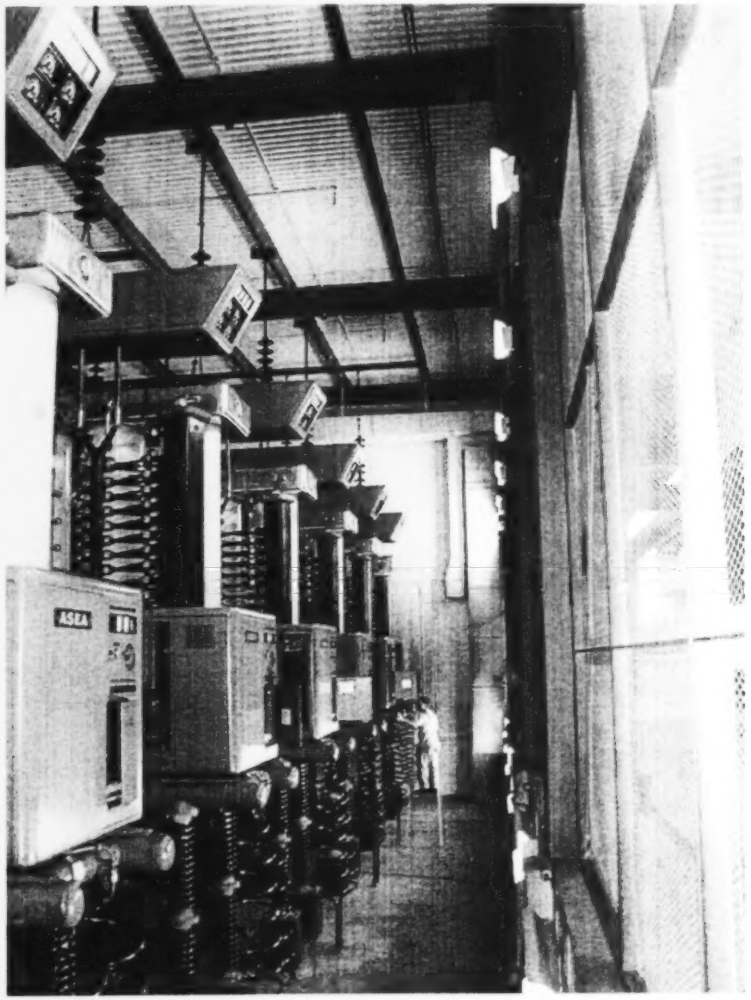
Converter Transformer



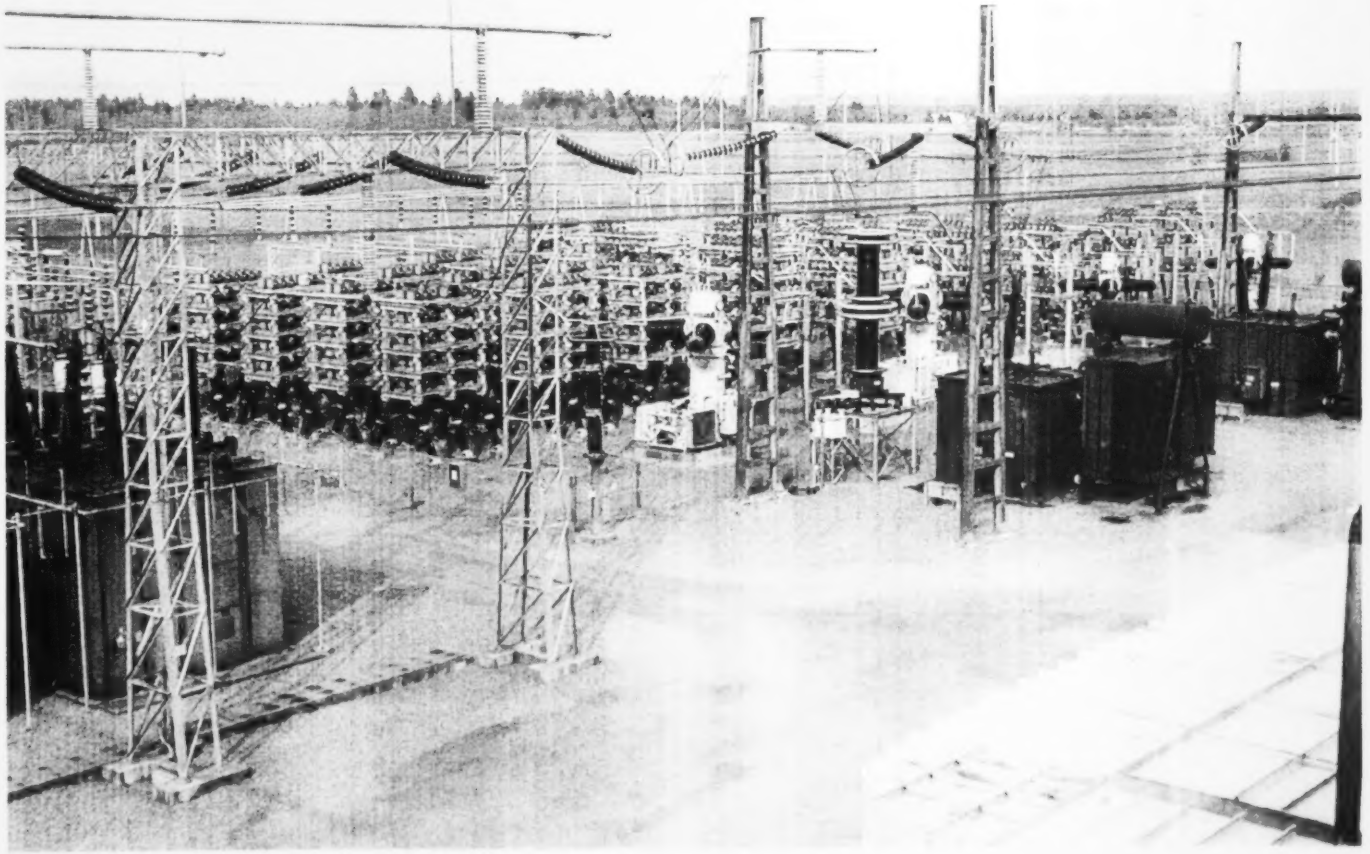
Thyristor Valves



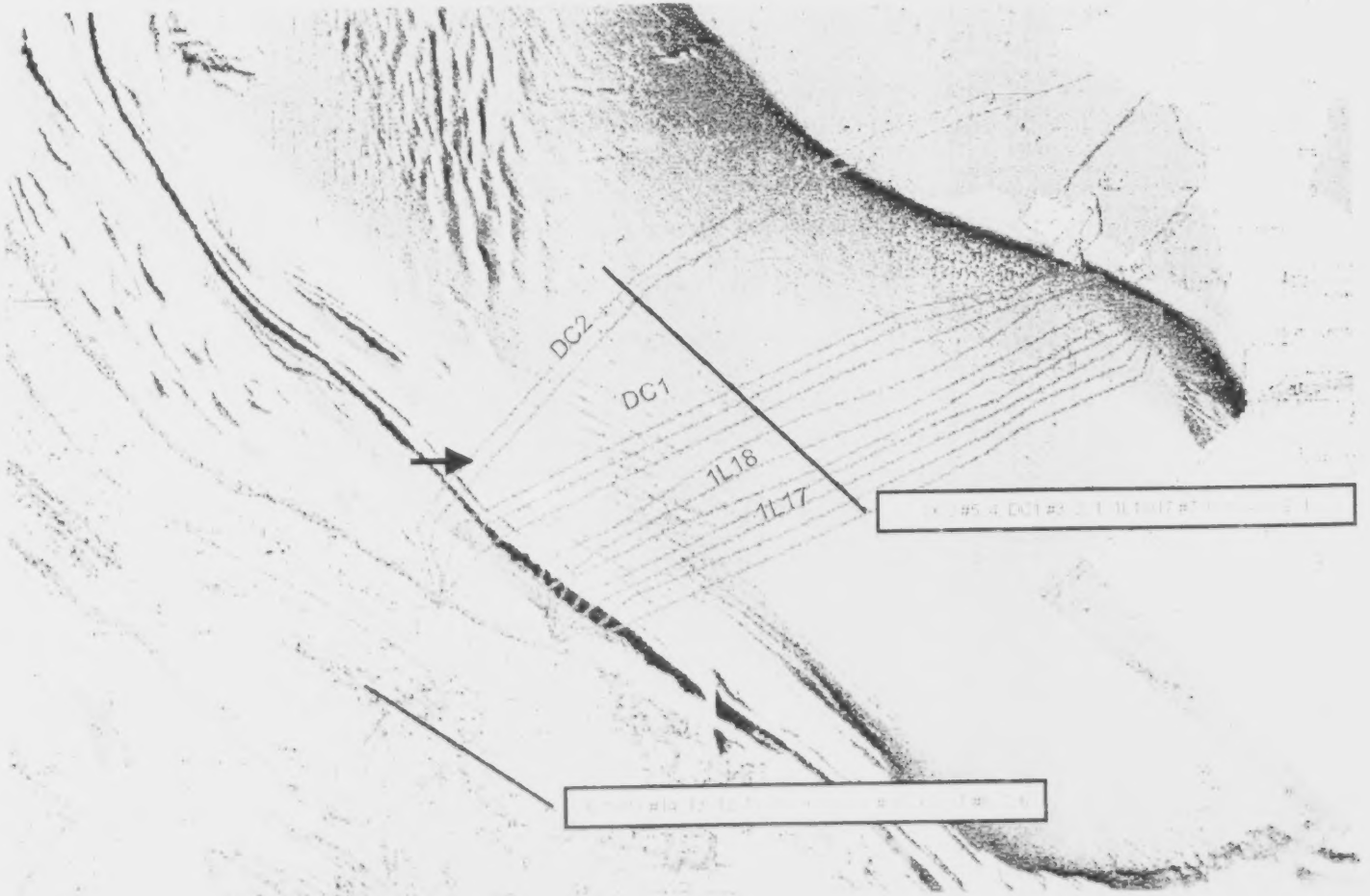
Mercury Arc Valves



Filters



HVDC Cable Routes



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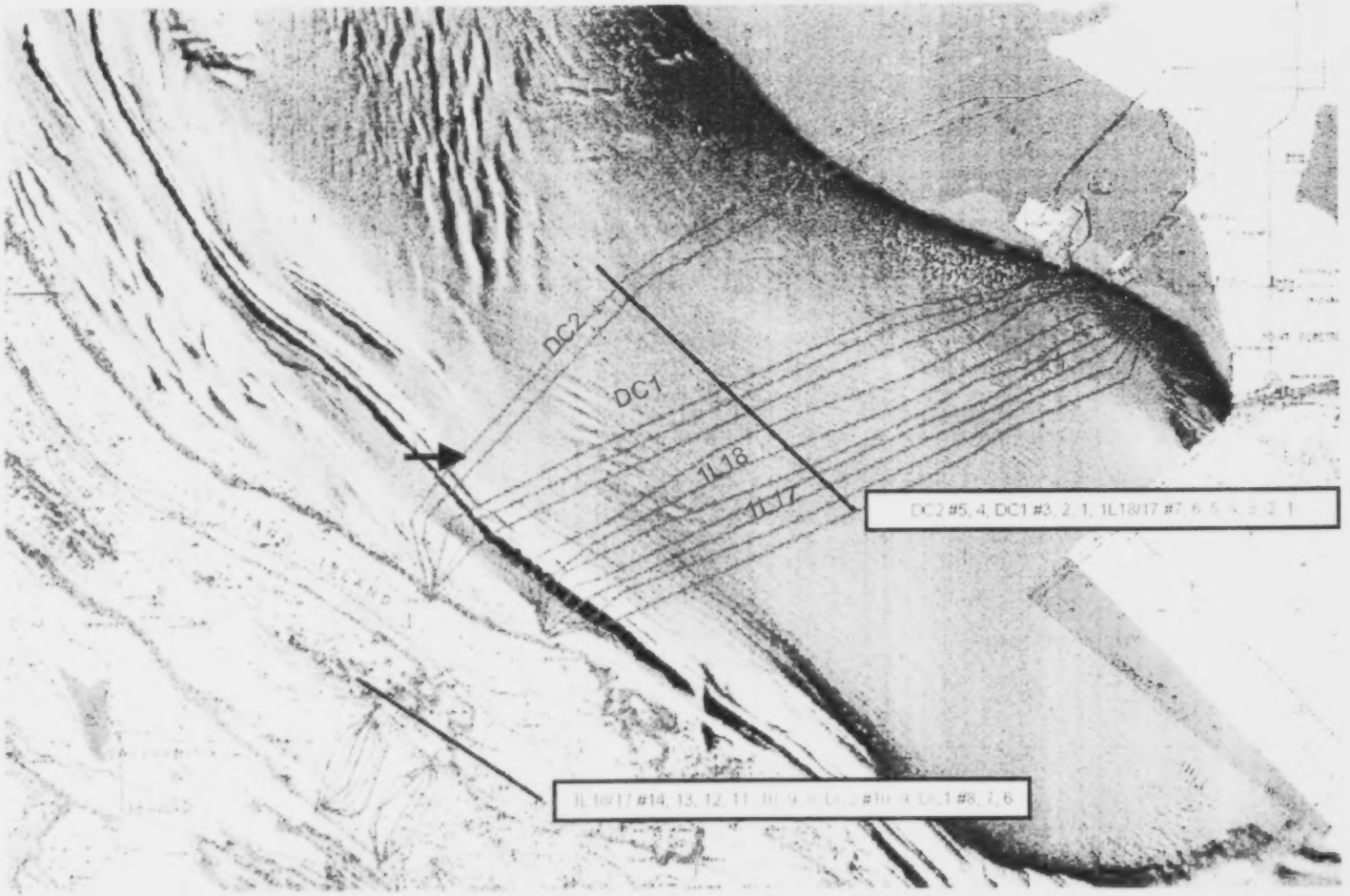
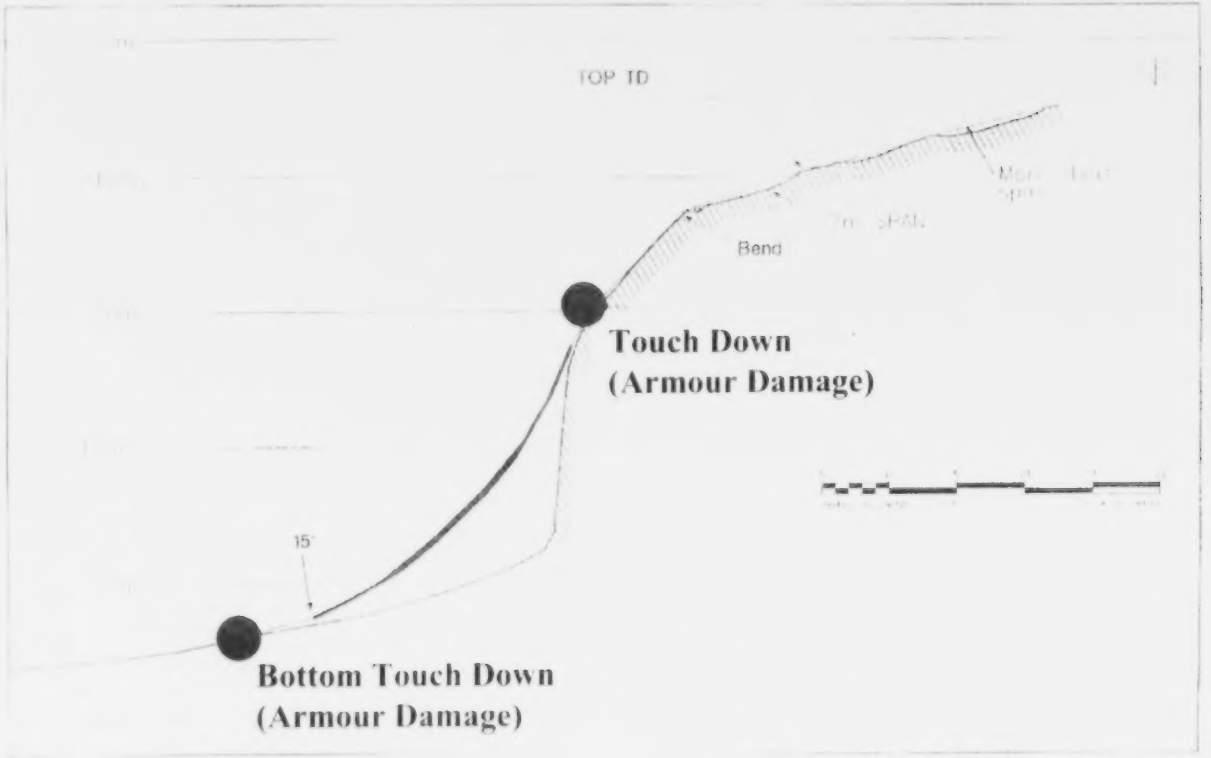


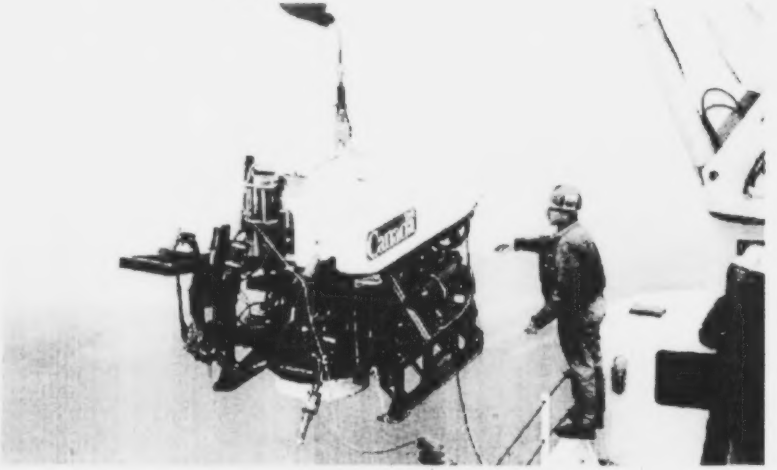
DC Cable 5 Profile at West side of Galiano Ridge



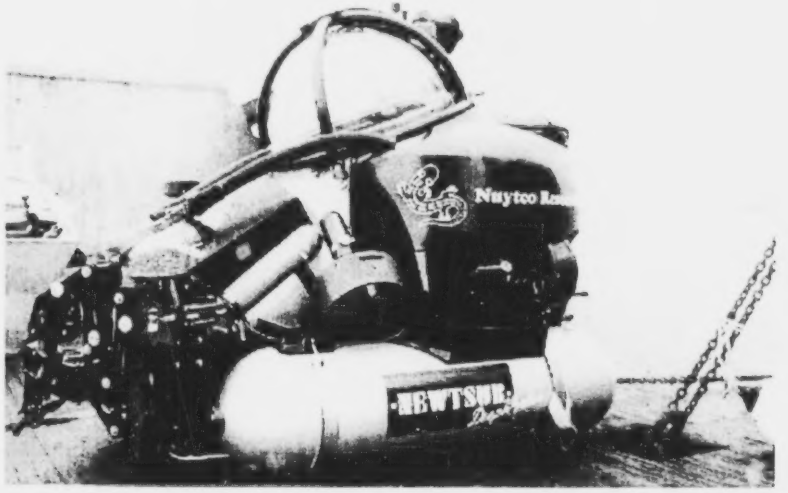
DC2 Cable 5 Profile at West Side of Galiano Ridge

Cable Survey

ROPOS Remotely Operated Vehicle Used in 1996 Survey

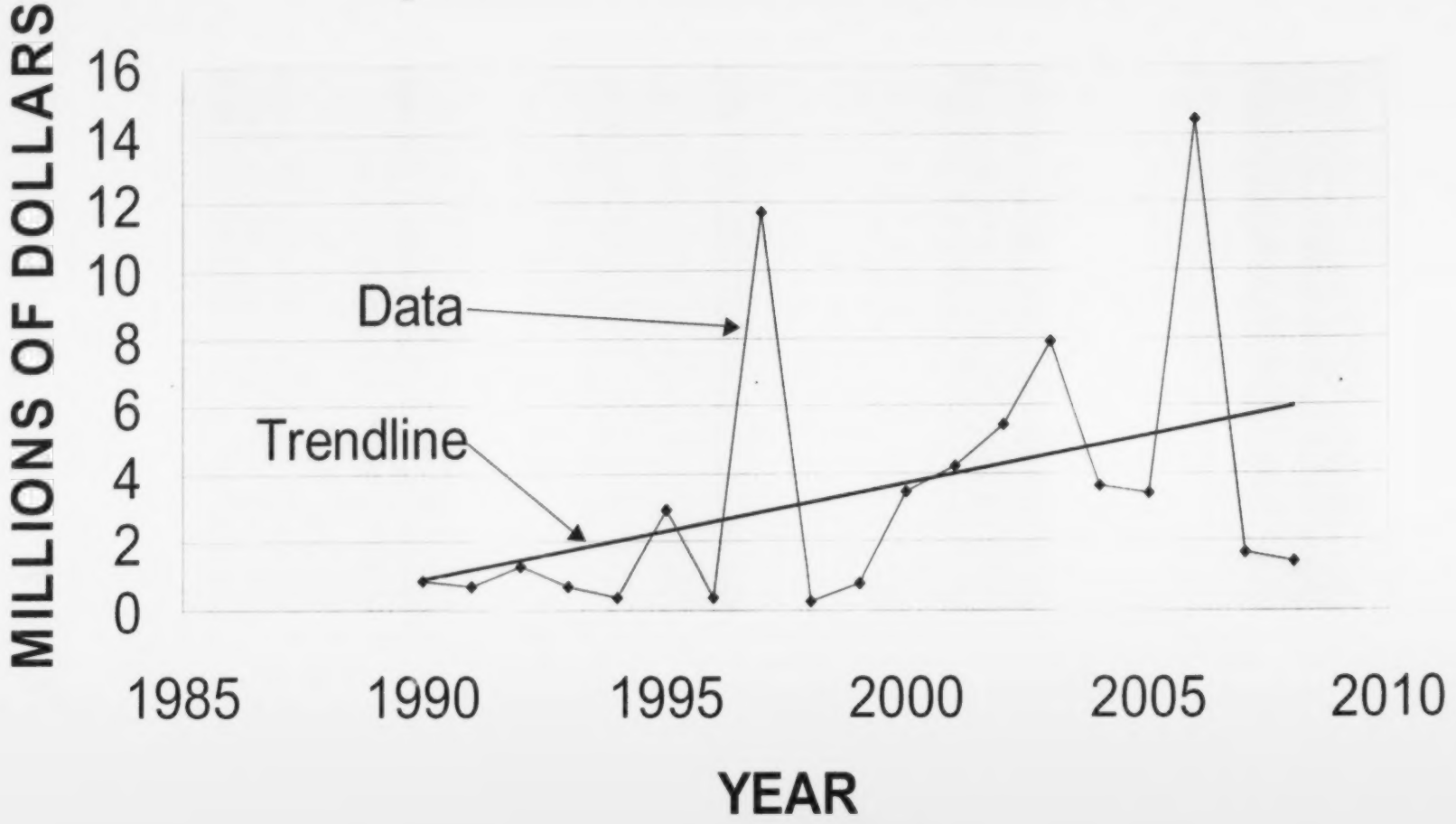


Deepworker Directly Operated Vehicle Used in 2001 Survey



September 2001 Photo at Top Touchdown Point of Major Suspension on Galiano Ridge Showing Five Broken Armour Wires

Expenditures on HVDC



HVDC System Condition

- Pole 1 and Pole 2 Submarine Cables
  - Armour Failing on some of the cable sections at Galiano Ridge
  - Cable 9 Failed; being replaced by fall 2003
  - Cable 5 Failure is imminent and being cut and capped and damaged section being replaced by fall 2003

HVDC System Condition Terminal Equipment

- Pole 1
  - Converter Station Equipment is degrading
  - Mercury Arc Valves performance is uncertain and dependent on valve rebuilt program
- Pole 2
  - Aging Insulation on Thyristor Valve Structures

HVDC Strategy

- Installed 1969 (Pole 1)- 1976 (Pole 2)
- HVDC equipment is aging (26 to 33 years old)
- The HVDC equipment is complex and requires a lot of maintenance.
- Reliability of aging equipment is uncertain.
- Long lead times are required for replacement transmission systems.

Why choose 2007 as end of life of HVDC for planning purposes

- The HVDC system is aging.
- Inadequate performance.
- Increasing expenditures without long term benefit.
- Seismic risk on cables and Arnott Station.
- The cost of being late is higher than the cost of being early.
- Supported by Engineering studies since 1993.

Conclusion

- Vancouver Island Supply System Reinforcement Drivers
  - Aging HVDC
  - Load Growth
- Investment Decisions Must be Made for Reliable Supply